Some Relationships in ...

$$na+(n-1)b<x<na+nb$$

$$C=1+\left[C_{01}-e^{\frac{a}{h}}+e^{\frac{a+b}{h}}-e^{\frac{2a+b}{h}}+\ldots+e^{-\frac{(n-1)(a+b)}{h}}-e^{-\frac{na+(n-1)b}{h}}\right]e^{-\frac{x}{h}} \quad (5)$$

$$C_{na+nb}=1-e^{-\frac{b}{h}}+e^{-\frac{a+b}{h}}-e^{-\frac{2a+b}{h}}+\ldots-e^{-\frac{na+(n-1)a}{h}}+C_{01}e^{-\frac{na+nb}{h}} \quad (5a)$$

and for the section $na+nb<x<(n+1)a+nb$

$$C=\left[C_{01}-e^{\frac{a}{h}}+e^{\frac{a+b}{h}}-e^{\frac{2a+b}{h}}+\ldots-e^{\frac{na+(n-1)b}{h}}+e^{\frac{na+nb}{h}}\right]e^{-\frac{x}{h}} \quad (6)$$

$$C_{(n+1)a+nb}=e^{-\frac{a}{h}}-e^{-\frac{a+b}{h}}+e^{-\frac{2a+b}{h}}-\ldots-e^{-\frac{na+nb}{h}}+$$

$$+C_{01}e^{-\frac{(n+1)a+nb}{h}} \quad (6a)$$

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Some Relationships in ...

From these the maximum and minimum concentrations can be found for each section

$$C_{ns+nb} = \left(1 - e^{-\frac{b}{k}}\right) \frac{e^{-\frac{ns+nb}{k}} - 1}{e^{-\frac{s+b}{k}} - 1} + C_{01} e^{-\frac{ns+nb}{k}} \quad (7)$$

$$C_{(n+1)s+nb} = e^{-\frac{s}{k}} \left(1 - e^{-\frac{b}{k}}\right) \frac{e^{-\frac{ns+nb}{k}} - 1}{e^{-\frac{s+b}{k}} - 1} + C_{01} e^{-\frac{(n+1)s+nb}{k}} \quad (7a)$$

From these it follows that the relative change in concentration for each section, which is defined as

$$\delta C = \frac{C_{ns+nb} - C_{(n+1)s+nb}}{C_{ns+nb}},$$

and is equal to $\delta C = 1 - e^{-\frac{s}{k}}$ (8)

Card 5/8

Some Relationships in ...

Similar calculations show that the maximum and minimum concentrations after second remelting are given by

$$C_{as+ab} = \frac{\left(1-e^{-\frac{b}{h}}\right)\left(e^{-\frac{as+ab}{h}}-1\right)}{e^{\frac{a+b}{h}}-1} + \left(C_{as}+\frac{a}{h}\sum_{k=1}^{s} D_k+\frac{b}{h}\sum_{k=1}^{s} E_k\right)e^{-\frac{as+ab}{h}};$$

$$C_{(s+1)a+sb} = \frac{e^{-\frac{a}{h}}\left(1-e^{-\frac{b}{h}}\right)\left(e^{-\frac{as+ab}{h}}-1\right)}{e^{\frac{a+b}{h}}-1} + \left(C_{as}+\frac{a}{h}\sum_{k=1}^{s+1} D_k+\frac{b}{h}\sum_{k=1}^{s} E_k\right)e^{-\frac{(s+1)a+sb}{h}}.$$

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Some Relationships in ...

where C_{02} is the concentration in the initial liquid

$$E_n = C_{01} - e^{\frac{a}{k}} + e^{\frac{a+b}{k}} - \ldots + e^{\frac{(n-1)a+(n-1)b}{k}} - e^{\frac{na+(n-1)b}{k}};$$

$$D_n = C_{01} - e^{\frac{a}{k}} + e^{\frac{a+b}{k}} - \ldots - e^{\frac{na+(n-1)b}{k}} + e^{\frac{na+nb}{k}}.$$

The equations deduced were verified by zone melting with rapid movement of the liquid zone, this being the easiest to carry out. The rate of movement of the furnace was 5 mm/min, the length of the liquid zone being 60 mm. A composite billet (corresponding to the composite electrode) was made up from plates of pure lead and pure zinc to give an average composition of 90% Pb, 10% Sn. Specimens made from electrodes with various ratios of the volume of the single lead-tin portion to that of the liquid zone were used. After zone melting, the specimens were cut into plates 2.5 mm long and analysed. The experimental and theoretical curves of tin content as functions of length along specimen agree satisfactorily. Relative longitudinal fluctuations of composition were calculated

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S/536/60/000/043/010/011
E111/E435

and were also found to support the theoretical equations: the smaller the volume of the portion relative to that of the liquid bath the greater the uniformity of the billet. The authors emphasize that although the ideas of this paper have been developed for zone melting they can be applied to billets obtained from a consumable electrode. There are 7 figures and 3 Soviet references.

23019

18.1000 S/536/60/000/043/011/011
E111/E435

AUTHORS: Petrov, D.A., Doctor of Chemical Sciences, Professor and Kolachev, B.A., Candidate of Technical Sciences

TITLE: Non-Equilibrium Crystallization of Ternary Alloys

PERIODICAL: Moscow. Aviatsionnyy tekhnologicheskiy institut. Trudy. No.43. 1960. pp.117-129. Termicheskaya obrabotka i svoystva stali i legkikh splavov

TEXT: D.A.Petrov has shown (ZhFKh, 1947, T.XXI, No .12) that alloy crystallization can be considered as two processes occurring in parallel: separation of crystals of the solid phase from the liquid and change in the composition of crystals formed at a higher temperature through reaction with the liquid at a lower temperature. The authors now consider the crystallization of an alloy with two alloying components, with no diffusion in the solid state and a continuous series of solid solutions. For equilibrium conditions the changes in liquid and solid compositions as crystallization proceeds can be found from phase diagrams with the aid of Konovalov's rule. For non-equilibrium conditions crystallization is not completed at the temperature corresponding to the intersection of the alloy ordinate with the solidus surface.

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E111/E435

Non-Equilibrium Crystallization ...

Crystallization in the assumed system then ends at the fusion temperature of the lowest-melting component. In non-equilibrium crystallization of alloys belonging to a system with four-phase eutectic transformation the lines showing changes of liquid- and solid-phase composition changes will also be displaced from the equilibrium lines depending on the overall conode position in the primary-crystallization region. For the conditions specified the crystallization of any alloy of the ternary system is completed with the crystallization of the ternary eutectic. Non-equilibrium crystallization of ternary-system alloys with a peritectic four-phase transformation ends with the solidification of the binary $\beta + \gamma$ eutectic. For the experimental verification of their ideas the authors chose the method of drawing solid phase from the melt, since this largely satisfies the conditions specified in the theoretical treatment. Transformation of the equations deduced gives the distribution of components along the drawn specimen, but through lack of data the authors had to confine themselves to a qualitative verification. The systems Al-Cu-Si and Al-Cu-Mn were chosen, for which phase diagrams can be constructed from published data (H.W.Phillips, J.Inst. of Metals, 1953, T.82,p.9-15:

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Non-Equilibrium Crystallization ...

H.W.L.Phillips, W.Day, J.Inst. of Metals, 1947, 74, p.33-47). The test compositions were: Al + 4% Cu + 3% Si; Al + 8% Cu + 1.0% Si; Al + 4% Cu + 0.6% Mn; Al + 2.25% Cu + 1% Mn; Al + 0.5% Cu + 1.3% Mn. Aluminium (99.98% Al, 0.02% (Fe + Si)), electrolytic copper and manganese, and silicon (0,25% Fe, 0.20% Al) were used for preparing alloys; copper, silicon and manganese being introduced as alloys. Specimens were drawn at 0.07 mm per minute in the apparatus previously described by Petrov and Bukhanova (ZhFKh, 1953, T.27, No .1). After microstructural examination, samples of the solid were taken for chemical analysis; liquid-phase compositions were calculated. Fig.7 shows changes in the copper and silicon contents for the solid and liquid phases with respect to relative length (continuous lines relate to liquid and broken lines to solid phases, respectively); the corresponding curves for copper and manganese distribution are shown in Fig.9. These results and microstructure-examination show that not all the range of composition expected from the theoretical treatment is found. This is due to the fact that at low concentrations of the alloying components the range of the binary

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Non-Equilibrium Crystallization ...

eutectic is very small. For example, in the alloy obtained from Al + 4.5% Cu + 0.5% Si, 0.91 of the specimen will consist only of α-solid solution (of variable composition). Thus the binary and ternary eutectics crystallize at the last moment, when drawing conditions are already disturbed and complete replacement of one structural component by another does not occur. Nevertheless, the general change of composition and microstructure confirms the theoretical treatment both for drawing and for non-equilibrium crystallization in general. There are 10 figures and 3 references: 1 Soviet-bloc and 2 non-Soviet-bloc. The two references to English language publications read as follows:
H.W.L.Phillips, J.Inst. of Metals, 1953, T.82, p.9-15;
H.W.L.Phillips, W.Day, J.Inst. of Metals, 1947, 74, p.33-47.

Card 4/6

LIVANOV, V.A., prof.; BUKHANOVA, A.A., kand.tekhn.nauk; KOLACHEV, B.A., kand.tekhn.nauk

Effect of hydrogen on the structure and properties of BT8 and BT10 alloys. Trudy MATI no.50:52-60 '61. (MIRA 14:10)
(Titanium alloys--Hydrogen content)

30925
S/536/61/000/050/007/017
D217/D304

18.1285

AUTHORS: Livanov, V.A., Professor, Bukhanova, A.A., and Kolachev, B.A., Candidates of Technical Sciences

TITLE: Influence of grain size on the hydrogen embrittlement of titanium and its alloys

SOURCE: Moscow. Aviatsionnyy tekhnologicheskiy institut. Trudy, no. 50, 1961, Voprosy metallovedeniya, 61-70

TEXT: The main purpose of this paper was to investigate the influence of hydrogen on the mechanical properties of fine grained and coarse grained titanium and its alloys. Specimens of commercially pure titanium were made from forged rods and annealed in vacuo at 700°C, 900°C and 1100°C. Annealing at 700°C results in a fine-grained structure; at 900°C, medium-sized grains form, whilst at 1100°C the structure becomes coarse-grained. After vacuum annealing, the specimens were furnace-cooled. Various quantities of hydrogen were then introduced into them at the same temperatures at which vacuum annealing had been carried out.

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D217/D304

Soaking time before and after saturation with hydrogen at the above temperatures was one hour in each case. The subsequent cooling was carried out in the furnace. The dependence of the mechanical properties of Ti on hydrogen content was studied after vacuum annealing at 1100°C and saturation with hydrogen at 1100°C and 900°C, and the microstructure of Ti saturated with hydrogen at various temperatures was compared with that of commercially pure Ti after vacuum annealing at the same temperatures. It was found that the coarse-grained metal had a greater tendency to hydrogen embrittlement than fine-grained material; this is due to differences in the nature of the hydride precipitates. In the fine-grained material, Ti hydrides separate along the grain boundaries in the form of compact, often formless, precipitates. In the coarse-grained material, Ti hydrides precipitate in the form of very fine platelets. This fine precipitate causes high stress concentrations and premature destruction of the metal. There are 8 figures.

18.1285

30926
S/536/61/000/050/008/017
D217/D304

AUTHORS: Livanov, V.A., Professor, Buchanova, A.A. and Kolachev, B.A. Candidates of Technical Sciences

TITLE: Influence of hydrogen on the thermal stability of the alloy ВТ 3-1 (VT3-1)

SOURCE: Moscow. Aviatsionnyy tekhnologicheskiy institut. Trudy, no. 50, 1961, Voprosy metallovedeniya, 71-81

TEXT: Specimens of alloy VT-3-1 were annealed in vacuo at 900°C for 6 hours. Mechanical tests were carried out after various isothermal annealing treatments on specimens of various hydrogen contents, at three different deformation rates: (a) 40 mm/minute (b) 4 mm/minute and (c) /minute. After vacuum annealing, the microstructure of the VT3-1 nsists of a supersaturated α-solid solution containing a small f of the β-phase. The structure of the alloy on being saturated drogen immediately after vacuum annealing remains essentially un- . Isothermal annealing at 450°C for 48 hours leads to a

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Influence of hydrogen ...

decomposition of the supersaturated solution and to the precipitation of the $TiCr_2$ phase, by eutectoid decomposition of β. The higher the temperature, the greater the rate of eutectoid decomposition. It is found that isothermal annealing leads to embrittlement of the VT3-1 alloy which is the more pronounced the higher the annealing temperature. Embrittlement is noticeable only after isothermal annealing at 550°C for over 100 hours. Hydrogen lowers the thermal stability of the alloy. The brittleness of an alloy containing more than 0.03% hydrogen manifests itself even after annealing at 350°C for 100 hours. The decrease in thermal stability of a VT3-1 alloy containing hydrogen is due to the fact that the latter accelerates decomposition of the β-phase and of the supersaturated α-solid solution. Besides, in the presence of hydrogen, Ti hydride or any other phase containing hydrogen, precipitation of phases other than $TiCr_2$ also occurs. Hydrogen lowers the thermal stability of the alloy VT3-1 to a lesser degree than that of the alloy VT3, since the β-phase in the former is more stable than in the latter. There are 7 figures and 3 references: 1 Soviet-bloc and 2 non-Soviet-bloc. The reference to the English-language publication reads

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Influence of hydrogen ...

as follows: R.I. Jaffee, G.A. Lenning, C.M. Craighead, J. of Metals, 1956, no. 8, pp. 907-913.

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30927
S/536/61/000/050/009/017
D217/D304

18 1285

AUTHORS: Livanov, V.A., Professor, Buchanova, A.A., and Kolachev, B.A., Candidates of Technical Sciences

TITLE: Influence of oxygen and hydrogen on the structure and properties of titanium

SOURCE: Moscow. Aviatsionnyy tekhnologicheskiy institut. Trudy, no. 50, 1961, Voprosy metallovedeniya, 82-92

TEXT: The combined influence of oxygen and hydrogen on the mechanical properties and structure of Russian commercially pure titanium was investigated. Ingots were melted in a laboratory arc furnace, using a soluble segmented electrode. The electrodes were compacted from sponge containing the following impurities: 0.1% Fe, 0.05% Si, 0.05% Mg, 0.05% Cl, 0.1% SO_2, 0.01% H_2, 0.03% N_2 and 0.03% Ni. Oxygen was added to each portion of the electrode in the form of calculated quantities of TiO_2. By this method, ingots with the following supplementarily added oxygen

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Influence of oxygen ...

contents were made: 0, 0.06, 0.1, 0.2, 0.3, 0.5 and 1.0 wt.%. After the first remelting, the ingots were ground and forged. The forged billets were then used as electrodes for the second remelting process. The ingots obtained by double remelting were forged into rods of 12 x 12 mm cross section at 980-1000°C. After hot forging, the rods were cooled in air and cut into sections for specimens for mechanical testing. The mechanical test specimens were vacuum annealed at 900°C for 6 hours, after which they were furnace-cooled. They were then saturated with hydrogen to various concentrations. The hydrogen content of the specimens was determined from the change in hydrogen pressure in a system of known volume, and from the gain in weight of the specimens. After being saturated with hydrogen, the specimens were furnace-cooled. Their mechanical properties were determined at room temperature. After testing, the microstructure of undeformed portions of the specimens was studied. The oxygen content of the alloys was determined by the equilibrium pressure of hydrogen introduced into it. It was found that the joint presence of oxygen and hydrogen in Ti greatly affects the structure and properties

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Influence of oxygen ...

of the latter. At low contents of these impurities (up to 0.3 wt.% O_2 and up to 0.03 wt.% H_2) hydrogen does not exert a noticeable influence on the strength of Ti, but seriously reduces the plasticity characteristics, particularly the impact resistance. At high oxygen contents, hydrogen sharply decreases the strength and plasticity of Ti. In amounts not exceeding 0.5-0.7 wt.%, oxygen sharply increases the U.T.S. and yield strength. 0.01 wt.% oxygen increases the U.T.S. and yield strength of Ti by 1.3 kg/mm^2. In the joint presence of H_2 and O_2 in Ti and its alloys, a Ti hydride precipitate appears. The latter is characterized by a greater degree of dispersion at greater oxygen contents of Ti. Oxygen does not appear to have a great influence on the solubility of hydrogen in α-titanium at room temperature. There are 12 figures and 6 non-Soviet-bloc references. The 4 most recent references to the English-language publications read as follows: T.S. Liu, M.A. Steinberg, Transaction of the American Society for Metals, 1957, 50, Preprint no. 34; G.A. Lenning, C.M. Craighead, R.I. Jaffee, J. of Metals, 1954, v.6, p. 367; G. Weinig, J. of Metals, 1957, v. 9, no. 10; G.A. Lenning, J.W.

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18 1285

30928
S/536/61/000/050/010/017
D217/D304

AUTHORS: Livanov, V.A., Professor, Buchanova, A.A., and Kolachev, B.A., Candidates of Technical Sciences

TITLE: Hydrogen embrittlement of titanium-aluminum alloys

SOURCE: Moscow. Aviatsionnyy tekhnologicheskiy institut. Trudy, no. 50, 1961, Voprosy metallovedeniya, 93-102

TEXT: The purpose of the present work was to investigate the influence of Al, one of the main alloying elements of many industrial Ti alloys, on the hydrogen embrittlement of Ti. To study the influence of Al on the mechanical properties and structure of Russian technically pure Ti in the presence of hydrogen, Ti-Al alloy ingots were made in a laboratory arc furnace, using soluble segmented electrodes. The electrodes were compacted from TiO sponge. Ingots containing 0, 3, 4, 7.5 and 10% Al were made. After the first remelting, the ingots were ground and forged. The forged billets were then used as electrodes for the second melting. The ingots obtained after repeated remelting were forged into rods of

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Hydrogen embrittlement ...

14 x 14 mm cross section at 1050°C. After hot forging, the rods were cooled in air and cut into sections for specimens for mechanical testing. The specimens were annealed in vacuo at 900°C for 6 hours, after which they were furnace cooled. They were then saturated with hydrogen to various concentrations and again furnace-cooled. Mechanical testing of the hydrogen-saturated specimens was carried out at room temperature. The microstructure was studied, using the undeformed portions of impact text pieces. It was found that Al reduces the tendency of Ti to hydrogen embrittlement; this is due to the increased solubility of hydrogen in the α-solid solution and to the retardation of the diffusion of hydrogen in Ti in the presence of Al. The maximum permissible hydrogen content of a Ti alloy containing 5% Al (VT5) is approximately 0.03%, i.e. twice that permissible for commercially pure Ti. There are 10 figures and 3 non-Soviet-bloc references. The references to the English-language publications read as follows: H.R. Ogden, D.I. Maykath, W.L. Finlay, R.I. Jaffee, J. of Metals, 1953, v. 5, no. 2, II, 267; G.A. Lenning, J.W. Spretnak, R.I. Jaffee, J. of Metals, 1956, vo. 8, no. 10, II.

Card 2/2

S/536/61/000/050/011/017
D217/D304

AUTHORS: Livanov, V.A., Professor, Musatov, M.I., Engineer, and Kolachev, B.A., Candidate of Technical Sciences

TITLE: Distribution of alloying elements in a titanium ingot produced by melting with the soluble segmented electrode

SOURCE: Moscow. Aviatsionnyy tekhnologicheskiy institut. Trudy, no. 50, 1961, Voprosy metallovedeniya, 103-116

TEXT: The main disadvantage of Ti ingots produced by arc melting with a soluble electrode is their inhomogeneity with respect to chemical composition. By mathematical calculations, it was found that a much more uniform distribution of alloy elements along the length and cross section of ingots could be obtained by melting with a soluble segmented electrode. The relative inhomogeneity of distribution of the alloying components in such an ingot depends essentially on the ratio between the volume of the active portion of the electrode and that of the molten bath. If the ratio between the molten bath volume and the electrode volume is

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KOLACHEV, B. A.

PHASE I BOOK EXPLOITATION SOV/6171

Livanov, Vladimir Aleksandrovich, Anna Arkhipovna Bukhanova, and Boris Aleksandrovich Kolachev

Vodorod v titane (Hydrogen in Titanium). Moscow, Metallurgizdat, 1962. 244 p. Errata slip inserted. 2900 copies printed.

Ed.: L. P. Luzhnikov; Ed. of Publishing House: M. S. Arkhangel'skaya; Tech. Ed.: L. V. Dobuzhinskaya.

PURPOSE: This book is intended for scientific workers, engineers, and technicians at plants and scientific research institutes engaged in the production, treatment, and application of titanium and its alloys. It may also be useful to aspirants and senior students at schools of higher technical education, who specialize in physical metallurgy, technology of heat treatment, casting, forming, and welding of metals. It may likewise be of interest to design engineers.

Card 1/[illegible]2

PETROV, D.A., prof., red.; KOLACHEV, B.A., kand. tekhn. nauk [translator]; L'VOVA, N.M., red.; PRIDANTSEVA, S.V., tekhn. red.

[New data on the production of single crystals of semiconductors] Novoe v poluchenii monokristallov poluprovodnikov; sbornik statei. Moskva, Izd-vo inostr. litry, 1962. 259 p. Translated from the English. (MIRA 16:11)

(Crystals--Growth) (Semiconductors)

TROSTYANSKAYA, Ye.B.; SHISHKIN, V.A.; SIL'VESTROVICH, S.I.; PANTELEYEV, A.S.; POLUBOYARINOV, D.N.; BALKEVHICH, V.L.; NATANSON, A.K.; KOLACHEV, B.A.; PETROV, D.A.; GOL'DBERG, M.M.; SHAROV, M.Ya., inzh., retsenzent; KITAYGORODSKIY, I.I., doktor tekhn. nauk, prof., retsenzent; LIVANOV, V.A., kand. tekhn. nauk, prof., retsenzent; TROSTYANSKAYA, Ye.B., red.; BABUSHKINA, S., ved. red.; TITSKAYA, B.F., ved. red.; VORONOVA, V.V., tekhn. red.

[New kinds of materials in engineering and industry]Novye materialy v tekhnike. Pod red. Trostianskoi E.B., Kolacheva, B.A., Sil'vestrovicha S.I. Moskva, Gostoptekhizdat, 1962. 656 p. (MIRA 16:2)

(Materials)

LIVANOV, V.A.; KOLACHEV, B.A.

Classification of titanium alloys according to their structure. Titan i ego splavy no.10:55-62 '63. (MIRA 17:1)

ACCESSION NR: AT 4007054 S/2598/63/000/010/0307/0316

AUTHOR: Livanov, V. A.; Bukhanova, A. A.; Kolachev, B. A.; Gusel'nikov, N. Ya.

TITLE: Hydrogen embrittlement of titanium alloys

SOURCE: AN SSSR. Institut metallurgii. Titan i yego splavy*, no. 10, 1963. Issledovaniya titanovy*kh splavov, 307-316

TOPIC TAGS: titanium alloy, VT-3-1 titanium alloy, titanium alloy embrittlement, titanium alloy hydrogen embrittlement, hydrogen embrittlement, VT-3-1 alloy embrittlement, VT-4 titanium alloy, VT-5 titanium alloy, VT-10 titanium alloy

ABSTRACT: It has been stated that hydrogen exerts a detrimental effect on the mechanical properties of titanium and its alloys. Introduction of small quantities of hydrogen into titanium and its alpha alloys drastically reduces their impact strength. Unlike alpha alloys, the alpha-beta alloys do not exhibit hydrogen embrittlement during impact ductility tests, but only in tests at small strain velocities. Hydrogen embrittlement of the alpha-beta alloy VT-3-1 and of the alpha alloys VT-4, VT-5, and VT-10 was studied by the authors at various hydrogen concentrations (0.002 — 0.05%) and strain velocities (0.1 — 4 mm/min), and after different heat and natural aging treatments. The mechanical

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ACCESSION NR: AT 4007054

properties measured in the tests conducted by the authors are the ultimate tensile strength, yield strength, specific elongation, and contraction of cross-sectional area of the test specimen. It was concluded that: (1) Alpha-beta alloys exhibit hydrogen embrittlement at low strain velocities and this embrittlement is assisted by low temperature and by the presence of notches. (2) A certain minimum hydrogen content is required for the development of alpha-beta alloy embrittlement. After standard heat treatment alloy VT-3-1 exhibits hydrogen embrittlement at a hydrogen content exceeding 0.03%; after quenching, however, alloy VT-3-1 shows hydrogen embrittlement at 0.01%. This embrittlement is accompanied by a reduction of plasticity and an increase of tensile strength. The decrease of plasticity appears, not immediately after quenching, but in the process of natural aging after quenching. (3) Titanium-base alpha alloys VT-4, VT-5, and VT-10 like the alpha-beta alloys, exhibit hydrogen embrittlement at low strain velocities. This can be explained by a regrouping of hydrogen under the influence of stresses. Consequently, it is necessary to revise the existing mechanism explaining the brittle fracture of alpha-beta alloys caused by hydrogen. It has been suggested that hydrogen embrittlement of alpha-beta alloys is caused by processes developing in both alpha and beta phases: hydrogen diffuses toward microdefects or grain boundaries where a formation of microvolumes enriched with hydrogen takes place; at hydrogen concentra-

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L 14321-65 EWT(m)/EWP(b)/EWP(t) ASD(m)-3/IJP(c) JD/MLK
ACCESSION NR: AT4048052 S/0000/64/000/000/0054/0057

AUTHOR: Kolachev, B. A.; Livano, V. A. B

TITLE: The relationship of the structures arising during quenching of titanium alloys to structural equilibrium curves 27

SOURCE: Soveshchaniye po metallurgii, metallovedeniyu i primeneniyu titana i yego splavov. 5th, Moscow, 1963. Metallovedeniye titana (Metallography of titanium); trudy* soveshchaniya. Moscow, Izd-vo Nauka, 1964, 54-57

TOPIC TAGS: alloy structure, alloy phase transformation, titanium alloy, quenching, phase diagram, martensite 18

ABSTRACT: Recently, many diagrams of the metastable phase composition of titanium alloys have been published, illustrating the structure of the alloys by showing phase composition as a function of temperature, but always after quenching. In principle, these diagrams have little to do with phase equilibrium curves unless the characteristics of the β-phase are already known and can be applied. In their consideration of alloys of titanium with a β-stabilizer, called a transition element, the authors neglect the formation of eutectoid compounds, since with titanium, they are formed only exceedingly slowly and have a negligible influence on the system after quenching. They also postulate that the concentration of

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ACCESSION NR: AT4048052

elements in the β-phase is below the critical concentration for each temperature at which a martensite (α') reaction goes to completion (represented by line M_μ in Fig. 1 of the Enclosure). A line M_k is constructed below which no martensitic transformation occurs. They then pick two temperatures, T_1 and T_2: Below T_1 the concentration of the β-stabilizer in the β-phase is above critical and there is no martensitic transformation; above T_2 no β-phase remains. Lastly, two concentrations of β-stabilizer are selected, C_1 and C_2: Below C_1 only the martensitic reaction occurs; above C_2 there is enough β-stabilizer to complete the transformation to the β-phase. Comparison of the suggested metastable diagrams in Figs. 1 and 2 of the Enclosure demonstrates a marked degree of agreement with the experimentally constructed ones in the literature. Furthermore, these permit a more exact interpretation of the experimental data. Orig. art. has: 5 graphs.

ASSOCIATION: none

SUBMITTED: 15Jul64 ENCL: 01 SUB CODE: MM

NO REF SOV: 006 OTHER: 000

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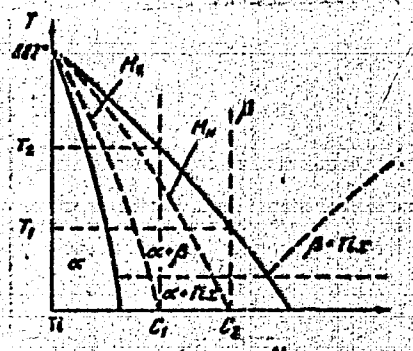
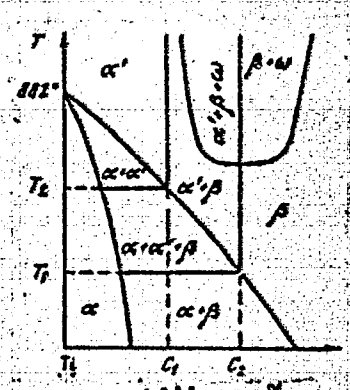
L 14321-65
ACCESSION NR: AT4048052

ENCLOSURE: 01



β-stabilizer, %

Fig. 1. Schematic diagram of the composition of titanium alloys with a transition element.



β-stabilizer, %

Fig. 2. Schematic metastable diagram of the phase composition of titanium alloys with a high degree of purity.

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L 14318-65 EWT(m)/EWP(b)/EWA(d)/EWP(w)/EWP(t) IJP(c)/ASD(m)-3 JD/MLK
ACCESSION NR: AT4048050 S/0000/64/000/000/0088/0094

AUTHOR: Kolachev, B.A., Livanov, V.A., Bukhanova, A.A.

TITLE: Dislocation theory of the hydrogen brittleness of titanium alloys

SOURCE: Soveshchaniye po metallurgii, metallovedeniyu i primeneniyu titana i yego splavov. Moscow, 1963. Metallovedeniye titana (Metallography of titanium); [illegible] Moscow, Izd-vo Nauka, 964. 88-94

TOPIC TAGS: dislocation theory, hydrogen brittleness, titanium alloy, titanium alloy brittleness, hydrogen atom mobility, brittleness, temperature

ABSTRACT: The study concerns the reversible brittleness developing in typical $\alpha + \beta$ alloys at low deformation rates. It is assumed that at a temperature below some critical T_0 the hydrogen will form Kottrell atmospheres at the dislocations; if the deformation rate is low and temperatures so high that the mobility of the hydrogen atoms [illegible] the deformation rate, the dislocations will transport the atmospheres to [illegible] of the grain this will result in segregation of the hydrogen facilitating de- [illegible] and enlargement of the grooves [illegible] the Kottrell formula $v_c = \frac{4D}{l}$ where v_c is the critical velocity at which the atmospheres

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ACCESSION NR: AT4048056

begin to be carried away by the mobile dislocations, D the diffusion coefficient of the admixture, and l the characteristic length. This formula is further developed. The critical deformation rate increases with temperature but does not depend on the hydrogen content of the alloy, while the temperature T_0 at which plasticity is restored [illegible] related T_0 depend on the mean hydrogen concentration. The temperature [illegible] hydrogen brittleness [illegible] envelope is bounded above by the dissociation temperature of the Kottrell atmospheres [illegible] The point of intersection of the curves characterizing these temperatures determines the maximal admissible hydrogen concentration for which no hydrogen brittleness will appear at a given deformation rate. This theory affords explanation of the regularities observed for the above alloys: their tendency towards hydrogen brittleness with increased hydrogen content decreased temperature and decreased deformation rate; the intercrystalline character of the break; higher temperatures for transit from viscous to brittle break with increased hydrogen content. The regularities to be expected from the dislocation theory agree satisfactorily with experimental data for the alloy Ti140A (0.0375% by weight H_2). Orig. art. has: 5 figures and 4 formulas.

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ACCESSION NR: AT4048056

SUBMITTED: 15Jul64 ENCL: 01 SUB CODE: MM

NO REF SOV: 003 OTHER: 002

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L 26139-65 EWT(1)/EWT(m)/EWP(w)/EWA(d)/EPR/T/EWP(t)/EWP(b) Pe-4 IJP(c)

ACCESSION NR: AP4047492 MJW/JD S/0149/64/000/004/0124/0129

40
39
B

AUTHOR: Livanov, V. A.; Bukhanova, A. A.; Kolachev, B. A.; Neverova-Skobelaya, [illegible]; Sheyn, O. B., Ye.; Shcherbina, L. V.

TITLE: Effect of hydrogen on the mechanical properties of titanium and OT4-1 alloy

SOURCE: IVUZ. Tsvetnaya metallurgiya, no. 4, 1964, 124-129

TOPIC TAGS: titanium, titanium alloy, titanium mechanical property, titanium alloy [illegible] hydrogen content, brittle failure/alloy OT4-1

ABSTRACT: The aim of this work was to study the influence of hydrogen on the mechanical properties of OT4-1 alloy, particularly on the impact strength, and to establish the maximum permissible hydrogen content at which the high resistance of the metal to brittle failure is still retained. For comparison, identical tests were carried out on technical-grade titanium, brand VT1-1. It was found that of all the properties studied, the impact strength of VT1-1 and OT4-1 was the most sensitive to changes in hydrogen content. The lower this content the lesser the tendency of the titanium alloys toward brittle failure. The authors were unable to establish the maximum permissible hydrogen

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ACCESSION NR: AP4047492

content and indicate the need for further investigations in this direction. Heating of OT-4 to 900C followed by cooling in air or in water reduces the adverse effect of hydrogen on the impact strength (at the hydrogen contents studied, i.e., up to 0.01%). However, additional experiments are needed for a better understanding of the stability of the properties obtained during the heat treatment and in the course of natural and artificial aging. Orig. art. has: 5 figures and 5 tables.

ASSOCIATION: Kafedra metallovedeniya i tekhnologii termicheskoy obrabotki, tekhnologicheskiy institut (Metal science and heat treatment department, Moscow aviation technology institute)

SUBMITTED: 30Aug63 ENCL: 00 SUB CODE: MM

NO REF SOV: 002 OTHER: 001

Card 2/2

EWT(m)/EWA(d)/EWP(t)/EWP(z)/EWP(b)/EWA(c) IJP(c) MJW/JD

UR/0129/65/000/005/0009/0015

ACCESSION NR: AP5013151

AUTHOR: Kolachev, B. A.; Livanov, V. A.; Bukhanova, A. A.; Gusel'nikov, N. Ya.

TITLE: The effect of hydrogen on the mechanical properties of quenched Ti alloys

SOURCE: Metallovedeniye i termicheskaya obrabotka metallov, no. 5, 1965, 9-15

TOPIC TAGS: titanium alloy, metal mechanical property

ABSTRACT: The structure and properties of VT3-1, VT8, and VT6 alloys were studied [illegible] to the effects of hydrogen. After processing, rods of 60-70 mm diameter [illegible] were treated in various ways to retain or remove hydrogen [illegible] removal [illegible] by heating in a vacuum furnace at [illegible] pickling. The properties were then compared to samples annealed by standard procedures. Vacuum annealed samples had higher ductilities and retained approximately the same strength levels. The effects of hydrogen were related to the mechanical properties of the Ti alloys, both after quenching, and after quenching and room temperature aging. In general, strength increased and ductility diminished with increased hydrogen content (0.001 to 0.04% H). The aging treatment offset the curves of strength and ductility, with ductility gradually diminishing with increased aging

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ACCESSION NR: AP5013151

times. Tests were run on V-8 alloy at high and low speeds of deformation. The
[illegible] properties did not change significantly, even at high contents of hydro-
[illegible] microstructural analysis of all the alloys in the quenched condition shows
[illegible] of increasing hydrogen contents. In general, increasing the H level re-
[illegible] increased amount of martensitic phase in the β-matrix. No changes
[illegible] the structures after prolonged room temperature aging.

Orig. art. has: 2 figures, 4 tables.

ASSOCIATION: none

SUBMITTED: 00 ENCL: 00 SUB CODE: MM

NO REF SOV: 000 OTHER: 000

Card 2/2

L 61833-65 EWT(m)/EWP(w)/EPF(c)/EWA(d)/T/EWP(t)/EWP(k)/EWP(z)/EWP(b)/EWA(c)
Pf-4/Pr-4 IJP(c) MJW/JD/HW/EM

ACCESSION NR: AP5016350 UR/0149/65/000/002/0131/0135
669.295

AUTHOR: Kolachev, B. A.; Livanov, V. A.; Bukhanova, A. A.; Gusel'nikov, N. Ya.

TITLE: Effect of cooling rate on the tendency of α titanium alloys toward hydrogen brittleness

SOURCE: IVUZ. Tsvetnaya metallurgiya, no. 2, 1965, 131-135, and insert facing p. 134

TOPIC TAGS: titanium alloy, hydrogen brittleness, tensile stress, metal deformation

... order to study the hydrogen brittleness of α alloys, the effect of hy- ... properties ... after furnace cool- ... and quenching in water) was investigated ... view, it was shown that these alloys, like (α + β)-alloys, tend to display hydrogen brittleness under certain conditions, when the cross-bars of the tensile impact testing machine move at slow rates. This brittleness develops to the greatest extent in quenched α titanium alloys. The approach used in determining the hydrogen brittleness in these alloys is therefore the same as that used for (α + β)-alloys.

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ACCESSION NR: AP5016350

In the case of annealed α alloys, the mechanical properties should be determined by tests involving high deformation rates, in particular, impact tests; in the case of [illegible] alloys, the cross-bars of the machine should be displaced at slow rates. [illegible] brittleness of quenched α titanium alloys which develops at slow defor- [illegible] is due to the decomposition of supersaturated solutions of hydrogen in the α phase under the influence of the applied stresses. The hydrides separating [illegible] supersaturated solutions under the influence of these stresses are preferentially arranged perpendicular to the direction of the tensile stresses, causing brittle failure. Orig. art. has: 4 figures.

ASSOCIATION: Kafedra metallovedeniya i termicheskoy obrabotki, Moskovskiy [illegible] tekhnologicheskiy institut (Department of Physical Metallurgy and Heat Treatment, Moscow Aviation Technological Institute)

SUBMITTED: 03Jan64 ENCL: 00 SUB CODE: MM, TD

NO REF SOV: 003 OTHER: 000

Card 2/2

L 5031-66 EWT(l)/EWT(m)/EWA(d)/EWP(t)/EWP(z)/EWP(b) IJP(c) MJW/JD

ACC NR: AP5022342 SOURCE CODE: UR/0149/65/000/003/0131/0135

AUTHOR: Kolachev, B. A.; Livanov, V. A.; Bukhanova, A. A.; Gusel'nikov, N. Ya.

ORG: Moscow Aviation Technological Institute (Moskovskiy aviatsionnyy tekhnologicheskiy Institut)

TITLE: Effect of hydrogen on the structure and properties of VT15 alloy

SOURCE: IVUZ. Tsvetnaya metallurgiya, no. 3, 1965, 131-135

TOPIC TAGS: alloy, titanium alloy, aluminum containing alloy, molybdenum containing alloy, chromium containing alloy, hydrogen containing alloy, alloy structure, alloy property/VT15 alloy

ABSTRACT: The effect of hydrogen on the structure and properties of VT15 β-aluminum alloy (3.7% Al, 7.35% Mo, 10.6% Cr, 0.11% Fe, 0.04% Si, 0.03%C, and 0.12% O_2) has been investigated. Forged bars 14 x 14 x 70 mm of twice vacuum-arc melted alloy were vacuum annealed at 900C for 6 hr, impregnated with hydrogen, annealed at 780C for 1 hr, and water quenched. Some bars after quenching were aged at 480C for up to 24 hr. It was found that the tensile and yield strengths of as-quenched alloy increased somewhat as the hydrogen content increased from 0.1 to 0.2%; the elongation and reduction of area dropped, however, the latter from 65.8% at 0.002% hydrogen to 53.4% at 0.2% hydrogen. At a

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L 5031-66

ACC NR: AP5022342

deformation rate of 4 mm/min, the tensile and yield strengths were higher than those obtained at a deformation rate of 0.4 mm/min at all hydrogen contents. The tensile strength of aged alloy is not affected by hydrogen at contents up to 0.05%, but drops with a further increase in hydrogen; at hydrogen contents of 0.002, 0.05, and 0.1% the tensile strength was 168, 169, and 152 kg/mm^2. Elongation and reduction of area increase from 3 and 10% at 0.002% hydrogen to 7 and 13% at 0.1% hydrogen. The structure of as-quenched alloy consisted of only the β-phase at all hydrogen contents. In aged alloy, the amount of precipitated α-phase decreases with increasing hydrogen content. Thus, hydrogen at contents up to 0.2% does not cause an embrittlement of heat-treated VT15 alloy at room temperature. It increases the stability of β-phase and reduces the rate of β-phase decomposition and the rate of α-phase formation. Orig. art. has: 4 figures. [AZ]

SUB CODE: MM/ SUBM DATE: 03Jan64/ ORIG REF: 004/ OTH REF: 001/

ATD PRESS: 4132

OC

Card 2/2

KOLACHEV, B.A.; LIVANOV, V.A.; BUKHANOVA, A.A.; GUSEL'NIKOV, N.Ya.

Effect of hydrogen on the mechanical properties of hardened titanium alloys. Metalloved. i term. obr. met. no.5:9-15 My '65. (MIRA 18:7)

KOLACHEV, B.A.; LIVANOV, V.A.; BUKHANOVA, A.A.; GUSEL'NIKOV, N.Ya.

Effect of hydrogen on the structure and properties of the VT15 alloy. Izv. vys. ucheb. zav.; tsvet. met. 8 no.3:131-135 '65. (MIRA 18:9)

1. Moskovskiy aviatsionnyy tekhnologicheskiy institut, kafedra metallovedeniya i termicheskoy obrabotki.

LIVANOV, V.A.; BUKHANOVA, A.A.; KOLACHEV, B.A.; NEVEROVA-SKOBELEVA, N.P.; SLAVINA, I.I.; SHEYNIN, E. Ye.; SHCHERBINA, L.V.

Effect of hydrogen on the mechanical properties of titanium and the OT4-1 alloy. Izv. vys. ucheb. zav.; tsvet. met. 7 no. 4: 124-129 '64 (MIRA 19:1)

1. Moskovskiy aviatsionnyy tekhnologicheskiy institut, kafedra metallovedeniya i tekhnologii termicheskoy obrabotki.

KOLACHEV, B.A.; LIVANOV, V.A.; BUKHANOVA, A.A.; GUSEL'NIKOV, N.Ya.

Effect of the rate of cooling on the tendency of α-titanium alloys toward hydrogen brittleness. Izv.vys.ucheb.zav.; tsvet.met. 8 no.2:131-135 '65. (MIRA 19:1)

1. Kafedra metallovedeniya i termicheskoy obrabotki Moskovskogo aviatsionnogo tekhnologicheskogo instituta. Submitted January 3, 1964.

L 38552-66 EWT(m)/EWP(k)/T/EWP(w)/EWP(t)/ETI IJP(c) GD/JD/HW

ACC NR: AT6012393 SOURCE CODE: UR/0000/65/000/000/0212/0220

AUTHORS: Kolachev, B. A.; Livanov, V. A.; Gusel'nikov, N. Ya.; Bukhanova, A. A.

ORG: none

TITLE: On certain general principles of the occurrence of hydrogen brittleness in alloys VT3-1 and VT15

SOURCE: Soveshchaniye po metallokhimii, metallovedeniyu i primeneniyu titana i yego splavov, 6th. Novyye issledovaniya titanovykh splavov (New research on titanium alloys); trudy soveshchaniya. Moscow, Izd-vo Nauka, 1965, 212-220

TOPIC TAGS: crack propagation, titanium containing alloy, alloy, martensite alloy, material deformation, hydrogen embrittlement / VT3-1 martensite alloy, VT15 alloy

ABSTRACT: A review is made of certain principles of hydrogen brittleness in alloys VT3-1 and VT15. The brittleness of (α + β)-titanium alloy VT3-1 is more intense at temperatures below room temperature and at low rates of deformation. β-titanium alloys at lower-than-room temperatures also tend toward hydrogen brittleness. The temperature of the occurrence of hydrogen brittleness decreases with increasing hydrogen content. Hydrogen brittleness of alloy VT15 occurs only at low rates of deformation in a narrow temperature interval from -30 to 10C. The brittleness of (α + β)-titanium alloys depends upon processes occurring in the β-phase during

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L 38552-66

ACC NR: AT6012393 3

plastic deformation. Since the β-phase content in alloy VT3-1 is, after isothermal annealing, similar to that in alloy VT15, the hydrogen brittleness in each develops in the same pattern under identical conditions of mechanical testing. The dislocation theory satisfactorily describes the brittleness phenomenon. The dislocations transport hydrogen to the edges of the grain, thus causing segregations of hydrogen leading to formation and propagation of cracks. The microscopic nature of crack formation and how hydrogen segregation serves to prevent plastic deformation at the tip of cracks are discussed. Orig. art. has: 8 figures.

SUB CODE: 11/ SUBM DATE: 02Dec65/ ORIG REF: 008/ OTH REF: 010

Card 2/2

L 40237-66 EWT(1)/EWT(m)/EWP(t)/ETI IJP(c) JD
ACC NR: AP6019642 SOURCE CODE: UR/0149/66/000/003/0094/0102

AUTHOR: Kolachev, B. A.; Livanov, V. A.; Bukhanova, A. A. 27 B

ORG: Department of Metallography and Thermal Processing, Moscow Aviation Technological Institute (Moskovskiy aviatsionnyy tekhnologicheskiy institut. Kafedra metallovedeniya i termoobrabotki)

TITLE: Phase diagram of the system titanium-oxygen-hydrogen

SOURCE: IVUZ. Tsvetnaya metallurgiya, no. 3, 1966, 94-102

TOPIC TAGS: titanium compound, oxygen compound, hydrogen compound, phase diagram

ABSTRACT: The isotherms of the equilibrium pressure of hydrogen in the system Ti-O-H were plotted at temperatures of 700 and 800C. Oxygen was found to increase the equilibrium pressure of hydrogen in the system, especially at a content of more than 5 wt. %. The isotherms have sharp bends corresponding to the transition from one phase region to another which permits finding the boundaries of all phase regions of the system in the investigated concentration range of oxygen and hydrogen except the interface between the $\alpha + \beta$ - and β - regions. Isobars of the equilibrium pressure of hydrogen in the system were plotted at 700 and 800C, from which the position of the conodes in the two-phase region and the boundary between the $\alpha + \beta$ - and β -regions were established. The isothermal cross sections of the

Card 1/2 UDC: 620.181.663.295'546.21'546.11

L 10383-67 EWT(m)/EWP(w)/EWP(t)/ETI IJP(c) JD/JH

ACC NR: AP6029676 (A) SOURCE CODE: UR/0136/66/000/008/0088/0090

AUTHORS: Kolachov, B. A.; Livanov, V. A.; Drozdov, P. D.; Bukhanova, A. A.

ORG: none

TITLE: Mechanical properties of alloy MA2-1 containing different concentrations of hydrogen

SOURCE: Tsvetnyye metally, no. 8, 1966, 88-90

TOPIC TAGS: magnesium alloy, hydrogen, hydrogen embrittlement / MA2-1 magnesium alloy

ABSTRACT: The mechanical properties of the alloy MA2-1 were determined as a function of its hydrogen content. The investigation was initiated to corroborate a mechanism for hydrogen embrittlement in metals, as proposed by B. A. Kolachov, V. A. Livanov, A. A. Bukhanova, and N. Ya. Gusel'nikov (Novyye issledovaniya titanovykh splavov. Izd. Nauka, 1965 s. 212). The mechanical properties of the specimens were ascertained after annealing in air and in vacuum at 300C for 10 hours. The hydrogen content of the specimens, determined after A. P. Gudchenko and A. K. Leont'yev (Sb. Trudy MATI, 1961, vyp. 49, s. 137), was 18 cm^3 and 9 cm^3 per 100 g respectively. The experimental results are presented graphically (see Fig. 1). It was found that these results agree with the proposed dislocation hypothesis of hydrogen embrittlement.

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UDC: 669.715:620.1

L 10683-67

ACC NR: AP6029676

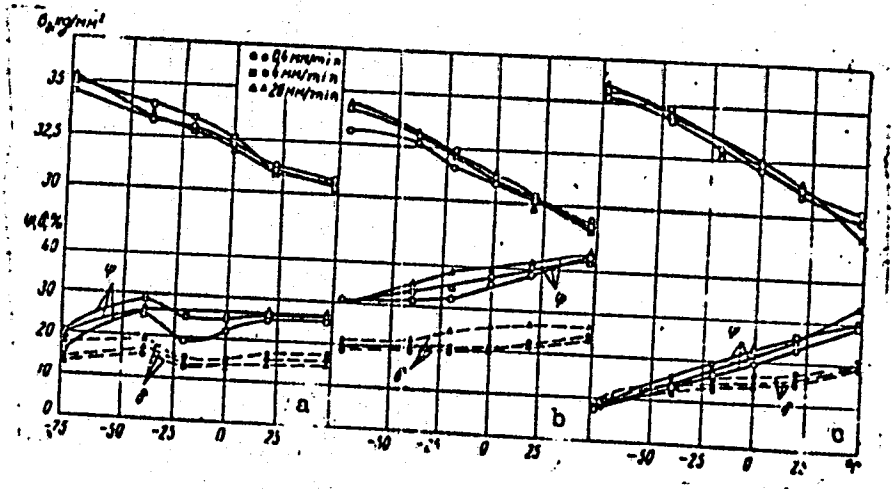

Fig. 1. Influence of the experimental temperature on the mechanical properties of alloy MA2-1: a - hot-pressed state; b - after vacuum annealing at 300C for 10 hours; c - after air annealing at 300C for 10 hours

Orig. art. has: 3 graphs.

SUB CODE: 11/ SUBM DATE: none/ ORIG REF: 003/ OTH REF: 001

Card 2/2

ACC NR: AT6036415 (A) SOURCE CODE: UR/2536/66/000/066/0063/0075

AUTHOR: Kolachev, B. A. (Candidate of technical sciences); Shevchenko, V. V. (Engineer)

ORG: none

TITLE: Growth kinetics of β-grain in industrial titanium alloys

SOURCE: Moscow. Aviatsionnyy tekhnologicheskiy institut. Trudy, no. 66, 1966. Struktura i svoystva aviatsionnykh staley i splavov (Structure and properties of aircraft steels and alloys), 63-75

TOPIC TAGS: metal pressing, titanium alloy, grain growth, phase composition, metalworking / VT5 Ti alloy, VT5-1 Ti alloy, VT3-1 Ti alloy, VT-6 Ti alloy, VT8 Ti alloy

ABSTRACT: The kinetics of grain growth in the β-region determines the optimal temperature and heating time of press worked titanium alloys and hence it is an important consideration. When pressworked at temperatures corresponding to the β-region these alloys are more easy to process technologically and are more readily forged, since the β-phase with its cubic structure displays greater plasticity than the α-phase and there is no marked anisotropy of properties as is the case for forging at temperatures corresponding to the (α + β) region. So far,

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UDC: 669.017:669.295

ACC NR: AT6036415

however, Ti alloys have not been pressworked at temperatures corresponding to the β-region owing to the decrease in their plasticity, which is attributed to the intense growth of grain in this region. In this connection, the authors investigated the kinetics of grain growth in the β-region for the Ti alloys VT5, VT5-1 (α-alloys) and VT3-1, VT-6, VT8 (α + β alloys) at 1000-1200°C for from 0.5 to 12 hr. Findings: β-grain at first grows at a fairly intense rate; as the annealing continues, however, this rate slows down. The growth of β-grain obeys a parabolic law of $D = kt^n$ (where D = mean grain diameter; k - constant dependent on temperature and material; t - annealing time; n - exponent dependent primarily on the material and, to a smaller degree, on temperature). The dependence of grain size on temperature for the investigated α and (α + β) alloys may be separated into three temperature intervals within which grain grows differently: at 1000-1050°C the grain growth rate is insignificant, owing to the impeding effect of the impurities segregating at the grain boundaries; above 1050°C the effect of impurities disappears and the grain growth rate gets intensified; beginning with roughly 1100°C the grain growth rate decreases, probably because then the grains acquire more or less stable shape and size. Orig. art. has: 7 figures, 2 tables, 2 formulas.

SUB CODE: 13, 11 / SUBM DATE: none/ ORIG REF: 002

Card 2/2

ACC NR: AT6036416 SOURCE CODE: UR/2536/66/000/066/0076/0086

AUTHOR: Kolachev, B. A. (Candidate of technical sciences); Bukhanova, A. A. (Candidate of technical sciences); Livanov, V. A. (Doctor of technical sciences; Professor)

ORG: none

TITLE: Phase distribution of hydrogen in ($\alpha + \beta$) titanium alloys

SOURCE: Moscow. Aviatsionnyy tekhnologicheskiy institut. Trudy, no. 66, 1966. Struktura i svoystva aviatsionnykh staley i splavov (Structure and properties of aircraft steels and alloys), 76-86

TOPIC TAGS: TEMPERATURE DEPENDENCE, titanium alloy, hydrogen, phase composition / VT6 titanium alloy

ABSTRACT: While it is known (Livanov, V. A., Bukhanova, A. A., Kolachev, B. A. Vodorod v titane, Metallurgizdat, 1962) that hydrogen in ($\alpha + \beta$) Ti alloys concentrates in the β-phase, the temperature dependence of the phase distribution of hydrogen still has not been established. Accordingly, the authors investigated the interaction between hydrogen and α- and β-phases of ($\alpha + \beta$) Ti alloys (the alloys Ti + 0.5% Mo and Ti + 12.5% Mo, representing the α- and β-phases of the Ti-Mo system in an equilibrium at 800°C, and the alloys Ti + 8% Al + 2% V and Ti + 4% Al + 6% V, representing the α- and β-phases of the industrial alloy VT6

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UDC: 669.017:669.295

(Ti + 6% Al + 4% V) in an equilibrium at 900-925°C) at various temperatures. Hydrogen was added in small portions to the vacuum-annealed alloy specimens, each succeeding portion being introduced only after the equilibrium pressure due to the addition of the preceding portion had set in. The amount of the hydrogen absorbed by the specimen was determined according to the pressure difference in the system. Findings: in the two-phase region hydrogen is nonuniformly distributed between the phases. The ratio between hydrogen concentrations in the β- and α-phases is determined by the entropic factors and by the heats of dissolution of hydrogen in the phases. At low temperatures in (α + β) Ti alloys hydrogen gets concentrated in the β-phase, since the thermal effect of the dissolution of hydrogen in this phase (taking polarity into account) is smaller than in the α-phase. At temperatures of the order of 800-900°C hydrogen satisfactorily dissolves in the β- and α-phases; the hydrogen concentration in the β-phase of the Ti-Mo and Ti-Al-V systems is only 1.3-1.4 times as high as in the α-phase. As the temperature decreases hydrogen migrates from the α-phase to the β-phase until the hydrogen concentration ratio between these phases C_β/C_α increase to several tens. The thermodynamic analysis of the solutions of hydrogen in α- and β-phases of Ti alloys applies to any two-phase system. Thus, hydrogen concentrations in the α- and β-phases of (α + β) Ti alloys are similar at high temperatures, and it is only at sufficiently low temperatures that hydrogen concentrates in the β-phase. It follows hence that the proneness of (α + β) Ti alloys to hydrogen brittleness must markedly depend on the test temperature and on the previous heat treat-

ACC NR: AT6036416

ment. The different solubility of hydrogen in different phases may be utilized for the internal degassing of one of the phases at the expense of the other. This method may greatly improve the plasticity of refractory metals which, as a rule, have bcc lattices and thus are particularly susceptible to contamination by interstitial impurities. The same principle can be utilized for the degassing of molten metals by means of substances which do not (or nearly do not) interact with these metals but have a great affinity for hydrogen. If, say, titanium is added to molten aluminum, hydrogen from the melt will migrate to the titanium. Orig. art. has: 7 figures.

SUB CODE: 11 / SUBM DATE: none/ ORIG REF: 006/ OTH REF: 001

Card 3/3

ACC NR: AT6036418 SOURCE CODE: UR/2536/66/000/066/0096/0102

AUTHOR: Kolachev, B. A. (Candidate of technical sciences); Livanov, V. A. (Doctor of technical sciences, Professor); Bukhanova, A. A. (Candidate of technical sciences); Gusel'nikov, N. Ya. (Engineer)

ORG: nono

TITLE: On the abrupt decrease in the plasticity of titanium at high temperatures

SOURCE: Moscow. Aviatsionnyy tekhnologicheskiy institut. Trudy, no. 66, 1966. Struktura i svoystva aviatsionnykh staley i splavov (Structure and properties of aircraft steels and alloys), 96-102

TOPIC TAGS: titanium, hydrogen, plasticity, brittleness, strain

ABSTRACT: According to a previous hypothesis by the first three of the authors (B. A. Kolachev et al. Issledovaniye titana i yego splavov, Izd-vo AN SSSR, 1963) the reason for the hydrogen brittleness of a number of metals is that the hydrogen-atom atmospheres forming at the dislocations are entrained by the latter in the presence of low straining rates, so that the hydrogen concentration at the grain boundaries or at other obstacles at which the disloca-

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UDC: 669.017:669.295

tions pile up becomes sufficient for a sharp acceleration of the development and propagation of cracks leading to fracture of the metal. Now the authors show that the hydrogen brittleness developing in the presence of low straining rates manifests itself within a temperature range (300-550°C) which corresponds to a specific value (10^{-5}-10^{-6} cm^2/sec) of the diffusion coefficient of hydrogen. In this connection, the authors investigate the effect of hydrogen on the mechanical properties of regular (0.002% H_2) and vacuum-annealed (0.02 and 0.05% H_2) rods of technically pure Ti subjected to tensile strength tests at normal (4 mm/min) and low (0.4 mm/min) straining rates. Findings: the minimum elongation per unit length for Ti in the presence of normal straining rate was recorded at 500°C (Fig. 1) while in the presence of the below-normal straining rate (0.4 mm/min) the mechanical properties of the Ti with 0.002% H_2 increase up to a point with increasing temperature whereas those of the Ti with 0.0% H_2 steadily decrease with increasing temperature. These experiments were organized on the assumption that the sharp decrease in the plasticity of Ti at high temperatures is due to hydrogen alone. The experiments revelaed, however, that this sharp decrease in plasticity within the temperature range of 300-550°C also occurs in technically pure Ti (0.002% H_2) — not as distinctly as in the Ti containing 0.05% H_2 but still distinctly enough. This sharp decrease is apparently due to the presence of O_2 and N_2 and resembles similar phenomena discovered

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ACC NR: AT6036418

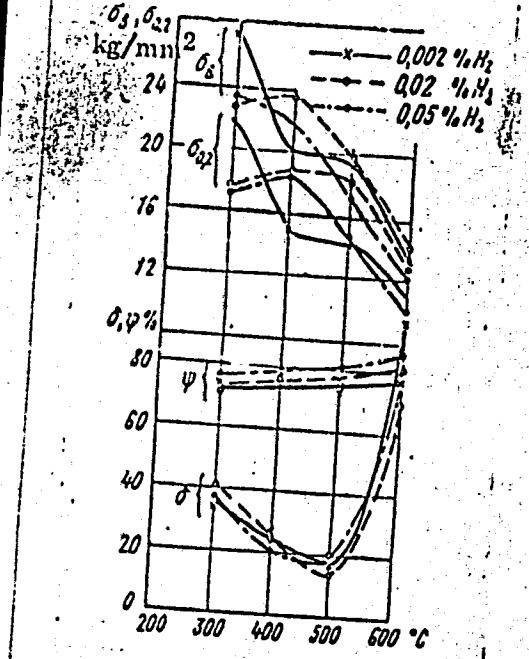

Fig. 1. Effect of temperature on mechanical properties of Ti containing various proportions of H_2 in the presence of a low straining rate.

in Nb, V and other metals. In the presence of hydrogen (0.05% H_2) the decrease in elongation at 400-500°C at low straining rates is compounded by the hydrogen brittleness due to the transport of hydrogen toward the grain boundaries. The effect of hydrogen on the properties of titanium within this temperature range is similar to the effect of strain aging. Orig. art. has: 5 figures.

SUB CODE: 11 / SUBM DATE: none
ORIG REF: 003/ OTH REF: 002

Card 3/3

ACC NR: AT6036419 (A) SOURCE CODE: UR/2536/66/000/066/0103/0113

AUTHOR: Kolachev, B. A. (Candidate of technical sciences); Faynbron, S. M. (Engineer)

ORG: none

TITLE: Effect of quenching from the α-region and subsequent tempering on the mechanical properties of the titanium alloy VT5-1

SOURCE: Moscow. Aviatsionnyy tekhnologicheskiy institut. Trudy, no. 66, 1966. Struktura i svoystva aviatsionnykh staley i splavov (Structure and properties of aircraft steels and alloys), 103-113

TOPIC TAGS: titanium alloy, metal heat treatment, tempering, mechanical property / VT5-1 titanium alloy

ABSTRACT: Contrary to the traditional theories, it is now known that quenching and tempering may induce structural changes in pure metals and single-phase alloys. These changes may be associated with Cottrell atmospheres, redistribution of dislocations and vacancies, interaction between defects and impurities, etc. In this connection, the authors attempted to utilize some of these effects to alter the properties of the α-Ti alloy VT5-1 (4.5% Al, 2.1% Sn, 0.04%

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UDC: 669.017:669.295

N_2, 0.15% O_2, 0.10% Fe, 0.15% Si, 0.003% H_2, 0.05% C, with Ti as the remainder), whose temperature of transition from the α-region to the (α + β) region is 950-975°C. Specimens of these alloys were quenched in water from 750, 850 and 950°C and tempered at 300, 400, 500, 600, and 700°C for from 1 to 7 hr. Findings: at room temperature the highest short-time tensile strength is displayed by specimens tempered at 600°C for 6 hr and the lowest, by specimens quenched from 750°C (Fig. 1). At higher temperatures the specimens display somewhat higher strength in quenched state than following standard annealing or tempering. A similar pattern is observed for the yield point and elongation. Thus, by means of quenching from the α-region and subsequent tempering it is possible to markedly influence the properties of the VT5-1 alloy and thus sometimes even correct defective castings: following its standard annealing this alloy has an ultimate strength of 96.9 kg/mm^2; by quenching and tempering this strength can be adjusted to from 89 to 98.3 kg/mm^2. Tempering of the quenched VT5-1 alloy at 300-600°C enhances its strength properties and reduces its impact toughness. These changes in properties following quenching from the α-region and tempering are attributable to the formation of impurity atmospheres on dislocations in the course of tempering. The binding energy between the oxygen atoms and dislocations is estimated at 0.25 ev, and between the atoms of nitrogen and carbon at approximately 0.4 ev, so that the condensation temperatures of impurity atmospheres must be roughly 300 and 500°C. Since the diffusion coefficients of oxygen and titanium are higher than those of nitrogen, at lower temperatures (300°C and lower)

ACC NR: AT6036419

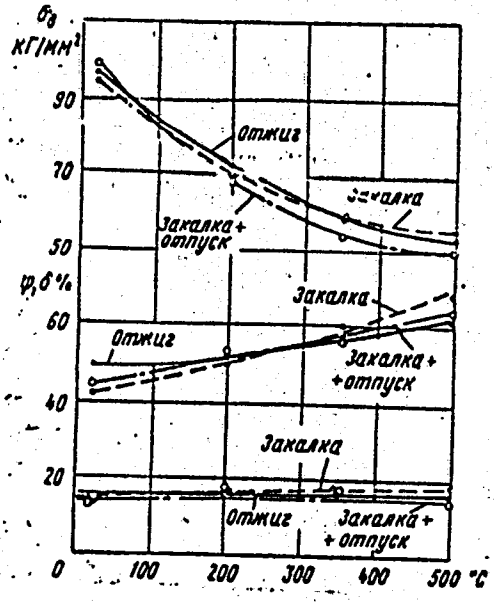

Fig. 1. Effect of temperature on mechanical properties of VT6-1 alloy following various regimes of heat treatment, during short-time tensile tests at high temperatures

Regimes of heat treatment:
1 - standard annealing; 2 - quenching from 750°C; 3 - quenching from 750°C and aging at 600°C for 6 hr

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ACC NR: AT6036419

oxygen-atom atmospheres apparently form on the dislocations, while at higher temperatures (400-600°C), at which oxygen atmospheres are unstable, the atmospheres form from atoms of nitrogen and carbon. Prolonged tempering at 600°C leads to the annihilation of the dislocations arising during quenching and to a decrease in hardening, particularly in stree-rupture tests. Orig. art. has: 7 figures, 1 table, 2 formulas.

SUB CODE: 11 / SUBM DATE: none/ ORIG REF: 005/ OTH REF: 003

Card 4/4

ACC NR: AT6036413 SOURCE CODE: UR/2536/66/000/066/0039/0052

AUTHOR: Kolachev, B. A. (Candidate of technical sciences); Livanov, V. A. (Doctor of technical sciences, Professor); Vishnyakov, D. Y. (Doctor of technical sciences, Professor); Lyasotskaya, V. S. (Engineer)

ORG: none

TITLE: Isothermal transformations in alloys of titanium with molybdenum

SOURCE: Moscow. Aviatsionnyy tekhnologicheskiy institut. Trudy, no. 66, 1966. Struktura i svoystva aviatsionnykh staley i splavov (Structure and properties of aircraft steels and alloys), 39-52

TOPIC TAGS: isothermal transformation, titanium base alloy, molybdenum, phase diagram, martensitic transformation

ABSTRACT: The literature on the isothermal transformations of alloys in the Ti-Mo system shows certain gaps. Thus, e.g. Bungardt and Ruedinger (Z. Metallkunde, 1961, no. 52(2)) specify below the initial temperature M_i of martensitic transformation only the line of the beginning and end of decomposition of the α'-phase whereas both the β-phase and the α'-phase

 UDC: 669.017:669.295'28

ACC NR: AT6036413

should isothermally decompose within the temperature range between M_i and the final temperature M_f of martensitic transformation. To fill this gap the authors investigated specimens of titanium alloys containing 2, 6, 9 and 13% Mo and, on the basis of the change in hardness following isothermal treatment and according to the results of metallographic, selective radiographic and dilatometric analyses, they constructed the pertinent isothermal transformation diagrams. Isothermal treatment of the specimens was accomplished by placing them in an electric furnace at 1000°C for 1 hr and thereupon transferring them to tin, lead or salt baths (at 300, 400 and 500-800°C, respectively) and, after definite intervals of time, cooling them in water. Findings: the isothermal transformation diagram (ITD) for the alloy Ti+2% Mo is represented by two series of lines describing the beginning and end of the decomposition of the β- and α'-phases. Within the temperature range from M_i to M_f these two series of lines overlap; the same applies to the ITD for the alloy Ti+6% Mo. On the other hand, the ITD for the alloy Ti+9% Mo also includes a line of formation of the ω-phase (at temperatures of < 450°C). For the alloy Ti+13% Mo the ITD is represented by lines of the beginning and end of decomposition of the β-phase and by a line restricting the region of existence of the ω-phase. These lines overlap and the region ($\alpha+\beta+\omega$) appears on the diagram. Thus increasing the Mo content above 9% complicates the formation of the ω-phase and shifts to the right the lines of the beginning of the segregation of this phase. The isothermal decomposition of the α'-phase in Ti alloys is usually accompanied

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ACC NR: AT6036413

by a decrease in hardness, while the decomposition of the β-phase leads to an increase in the hardness of the alloy and hence the pattern of variation in hardness with isothermal treatment is an indirect criterion of the phase composition of alloys of this kind. Orig. art. has: 12 figures, 1 table.

SUB CODE: 11, 20/ SUBM DATE: none/ ORIG REF: 002/ OTH REF: 006

Card 3/3

ACC NR: AT6036414 SOURCE CODE: UR/2536/66/000/066/0053/0062

AUTHOR: Vishnyakov, D. Ya. (Doctor of technical sciences, Professor); Kolachev, B. A. (Candidate of technical sciences); Lyasotskaya, V. S. (Engineer); Lebedeva, V. D. (Engineer)

ORG: none

TITLE: Isothermal transformations in alloys of titanium with chromium

SOURCE: Moscow. Aviatsionnyy tekhnologicheskiy institut. Trudy, no. 66, 1966. Struktura i svoystva aviatsionnykh staley i splavov (Structure and properties of aircraft steels and alloys), 53-62

TOPIC TAGS: titanium base alloy, chromium, isothermal transformation, phase diagram

ABSTRACT: The literature on this subject so far provides no information on isothermal transformations in alloys of the Ti-Cr system with hypo- and hypereutectoid compositions. To fill this gap, the authors constructed isothermal transformation diagrams (ITD) in alloys of Ti with 6 and 11% Cr (hypoeutectoid), 15% Cr (eutectoid) and 20% Cr (hypereutectoid) according to the change in hardness with isothermal treatment as well as according to the results of metallographic, radiographic and dilatometric analyses. Isothermal treatment at 600°C was

 UDC: 669.017:669.295'26

ACC NR: AT6036414

accomplished by rapidly cooling the specimens from a high temperature to the temperature of treatment, and at 550°C and below, after quenching. In both cases the isothermal treatment at > 300°C was performed in lead baths, and at 300-100°C, in baths of Wood's alloy. Findings: the hypoeutectoid and hypereutectoid alloys display two minima of β-phase stability: the low-temperature minimum, associated with the formation of the ω-phase, and the high-temperature minimum, conditioned by the hypoeutectoid segregation of the α-phase or $TiCr_2$. Increasing the Cr content above 6% complicates the segregation of the ω-phase and shifts to the right and downward the lines of the commencement of this segregation. The rate of formation of hypo-eutectoid segregations is the slower the closer the alloy's composition to the eutectoid point is. At low temperatures the β-phase decomposes nonuniformly; this is due not so much to the chemical heterogeneity of grains as to the heterogeneity of substructure, arising on rapid cooling of specimens or during the subsequent isothermal treatment. This substructure forms as a result of thermal stresses and the subsequent redistribution of dislocations. Orig. art. has: 10 figures.

SUB CODE: 11, 20/ SUBM DATE: none/ ORIG REF: 003/ OTH REF: 006

Card 2/2

ACC NR: AT6036417 SOURCE CODE: UR/2536/66/000/066/0087/0095

AUTHOR: Kolachev, B. A. (Candidate of technical sciences); Lyasotskaya, V. S. (Engineer)

ORG: none

TITLE: Effect of hydrogen on the processes occurring in the VT3-1 titanium alloy during aging

SOURCE: Moscow. Aviatsionnyy tekhnologicheskiy institut. Trudy, no. 66, 1966. Struktura i svoystva aviatsionnykh staley i splavov (Structure and properties of aircraft steels and alloys), 87-95

TOPIC TAGS: titanium alloy, hydrogen, metal aging, phase composition

ABSTRACT: Specimens of the VT3-1 titanium alloy (5.5% Al, 1.91% Cr, 2.05% Mo, 0.23% Si, 0.2% Fe, 0.04% C, 0.11% O_2, 0.01% H_2, with Ti as the remainder) were heated in electric furnaces at 840°C for 1 hr and water-quenched, after which they were aged for 2, 4, 6, 8 and 10 hr at 400, 500, 550 and 600°C, with subsequent water quenching. The H_2 content of some of the specimens was increased to 0.03 and 0.06%, and of others, reduced by vacuum annealing to 0.002%. Mechanical tests of the specimens showed that the specimens containing

Card 1/3 UDC: 669.017:669.295

ACC NR: AT6036417

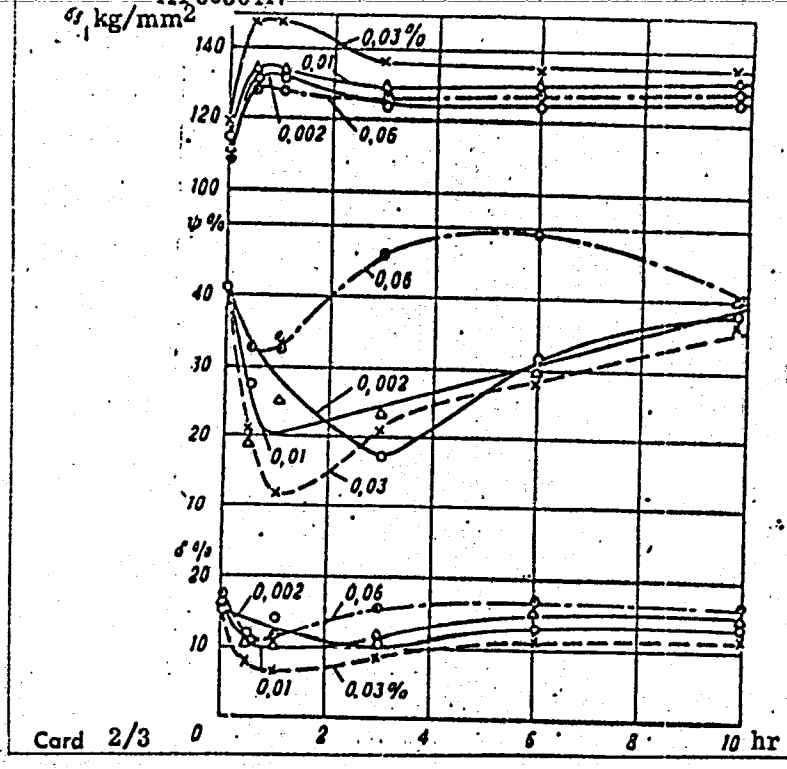

Fig. 1. Effect of aging time at 550°C on the mechanical properties of the VT3-1 alloy containing various proportions of H_2 following quenching from 840°C

APPROVED FOR RELEASE: 06/19/2000 CIA-RDP86-00513R000723710020-9"

ACC NR: AT6036417

0.002% H_2 have smaller strength and greater plasticity than the specimens containing 0.01 and 0.06% H_2. This difference is most appreciable after aging at 550°C (Fig. 1). Microstructural examination revealed that the amount of the residual α-phase in the quenched VT3-1 alloy decreases with increasing H_2 content. At temperatures below 500°C in the VT3-1 alloy quenched from 840°C the β-phase gets fixed by the quenching and its decomposition begins with the formation of the ω-phase. In the course of aging the metastable ω-phase gradually becomes transformed into the stable α-phase, which is accompanied by an increase in plasticity, while at temperatures above 500°C the decomposition of the β-phase results in the segregation of the α-phase alone. H_2 in concentrations smaller than 0.06% augments the amount of the ω-phase forming in the VT3-1 alloy during aging. Generally, H_2 is a stabilizer of the β-phase and so it augments the amount of the β-phase and hence also it enhances the effect of aging. Orig. art. has: 7 figures.

SUB CODE: 11/ SUBM DATE: none/ ORIG REF: 006/ OTH REF: 001

Card 3/3

ACC NR: AM6026330 Monograph UR/

Kolachev, Boris Aleksandrovich

Hydrogen brittleness of nonferrous metals (Vodorodnaya khrupkost' tsvetnykh metallov) Moscow, Izd-vo "Metallurgiya", 1966. 255 p. illus., biblio. 3100 copies printed.

TOPIC TAGS: ~~metallurgy~~, metal brittleness, hydrogen induced brittleness, metal, brittleness, hydrogen, mechanical property, titanium alloy

PURPOSE AND COVERAGE: This book is intended for use by metallurgists, technologists and engineers as well as by students doing advanced or graduate work. The book is devoted to problems concerning the interaction of hydrogen with metals, and the harmful effects this has on the properties of the metal. Considerable attention is given to processes that take place during the hydrogen-metal interaction, the state of hydrogen in liquid and solid solution, and the interaction of hydrogen with dislocations and other structural imperfections of metals. The effect of hydrogen on the structure and properties of the following metals are discussed: Be, Mg, Al, U, Ti, Zr, V, Nb, Ta, Cr, Mo. W. Pt, Cu, Ag, Au. Special attention is devoted to the hydrogen brittleness of Ti alloys.

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ACC NR: AM6066330

Card 2/2 SUB CODE: 11/ SUBM DATE: 02Jan66/ ORIG REF: 143/ OTH REF: 348/

ACC NR: AP7002867 SOURCE CODE: UR/0149/66/000/006/0142/0145

AUTHOR: Kolachev, B.A.; Livanov, V.A.; Bukhanova, A.A.; Gusel'nikov, N. Ya.; Lyasotskaya, V.S.

ORG: Department of Metal Science and Technology of Thermal Processing of Metals, Moscow Aviation Technology Institute (Moskovskiy aviatsionnyy tekhnologicheskiy institut, Kafedra metallovedeniya i tekhnologii termicheskoy obrabotki metallov)

TITLE: Effect of hydrogen on the structure and properties of variously heat-treated VT3-1 alloy

SOURCE: IVUZ. Tsvetnaya metallurgiya, no. 6, 1966, 142-145

TOPIC TAGS: hydrogen embrittlement, ductility, deformation rate, titanium alloy, ~~hydrogen containing titanium alloy~~, alloy strength, ~~alloy brittleness~~, alloy structure/VT3-1 alloy, ~~alloy ductility~~

ABSTRACT: Hydrogen-induced embrittlement of VT3-1 and other α + β titanium alloys depends not only on the hydrogen content, but to a considerable extent on the content of other impurities, heat treatment, grain size and the type and conditions of deformation. To determine the effect of the various factors, several series of specimens of modified (with increased Al, Fe and Si content) VT3-1 [U.S. Ti 155A] titanium alloy with a hydrogen content of up to 0.1 wt.% were annealed at 800C and slowly cooled, or annealed at 840 or 970C, quenched, aged at 550C for 0.5—3 hr. and then

Card 1/2 UDC: 669.018.1

ACC NR: AP7002867

subjected to tension tests at a deformation rate of 0.4—4.0 mm/min. In the alloy annealed and slowly cooled, a hydrogen content of up to 0.1% had no significant effect on the ductility of the alloy at a deformation rate as low as 0.4 mm/min, while in the as-quenched alloy deformed at the same rate, a substantial decrease in the reduction of area occurred at a hydrogen content of 0.003% H_2. However, at a strain rate of 4 mm/min, no noticeable change in the reduction of area was observed in as-quenched alloys containing up to 0.05% H_2. The brittleness of as-quenched alloy increased with increasing annealing temperature, since this decreased the amount of residual α-phase and increased the amount of the α-phase. An especially strong effect of hydrogen was observed in aged VT3-1 alloy. Short (0.5 hr) aging at 550C significantly increased the tensile and yield strengths of the alloy containing 0.03 and 0.05% hydrogen and sharply decreased the elongation and reduction of area. The alloy strength decreased and ductility increased with increasing aging time from 0.5 to 3 hr, but changed only slightly with still longer aging.

[WA-88]
[MS]

SUB CODE: 11, 13/ SUBM DATE: 27Apr65/ ORIG REF: 005/ OTH REF: 001
ATD PRESS: 5114

Card 2/2

KOLACHEV, M. P.

USSR / General and Special Zoology. Insects: Harmful Insects and Mites. Fruits and Berry Crop Pests. P

Abs Jour: Ref Zhur-Biol., No 1, 1959, 2335.

Author : Kolachev, M. P.
Inst : Turkmenian Institute of Agriculture.
Title : The Harmfulness of the Big Cotton-Boll Cicada (Cicadatra ochreata Mel.) in Turkmen Gardens.

Orig Pub: Tr. Turkme s.-kh. in-ta, 1957, 9, 83-86.

Abstract: The cicada (C) damages one-year shoots, while laying its eggs, most often on the sunlight side. The C makes 10.5 pricks per deposit in large-scale egg-deposits on an apple tree along 11.8 cm of the shoot, in small deposits it makes 4.8 pricks per 3.8 cm of the shoot, on the cherry tree it makes 14.7 pricks per 13 cm, on the

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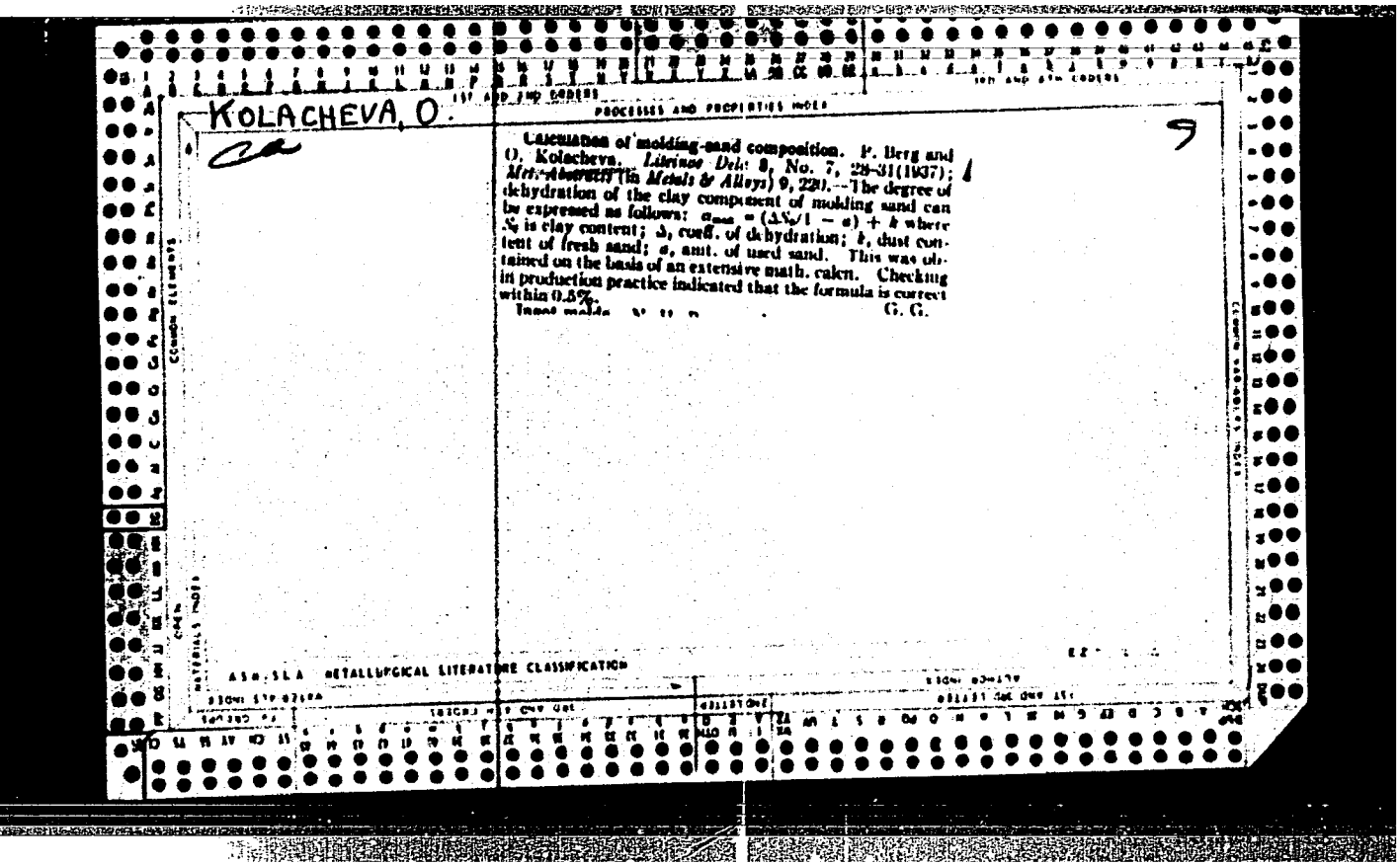

KOLACHEVA, O.

Ca

PROCESSES AND PROPERTIES INDEX

9

Calculation of molding-sand composition. F. Berg and O. Kolacheva. *Liteinoe Delo* 8, No. 7, 28-31(1937); *Met. Abstracts* (in *Metals & Alloys*) 9, 221.—The degree of dehydration of the clay component of molding sand can be expressed as follows: $a_{max} = (A\%/1 - a) + b$ where $A\%$ is clay content; A, coeff. of dehydration; b, dust content of fresh sand; a, amt. of used sand. This was obtained on the basis of an extensive math. calcn. Checking in production practice indicated that the formula is correct within 0.5%.

G. G.

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

SOV/137-57-1-783

Translation from: Referativnyy zhurnal. Metallurgiya, 1957, Nr 1, p 100 (USSR)

AUTHOR: Kolacheva, O. V.

TITLE: Some Problems Arising in the Production of Castings in Shell Molds Made With a Bakelite Binder (Nekotoryye voprosy polucheniya otlivok v obolochkovykh formakh na bakelitovom svyazuyushchem)

PERIODICAL: V sb.: Novoye v teorii i praktike liteyn. proiz-va. Moscow-Leningrad, Mashgiz, 1956, pp 373-381

ABSTRACT: Powdered bakelite and bakelite varnish (BV) were used as binders for the preparation of shell molds (SM). Molding mixtures (MM) to be made of powdered bakelite were prepared by the usual method; MM with BV were prepared in a pug mill after preheating to 50°C; the mixtures were then dried, milled, and screened through a Nr-40 screen. The utilization of a small amount of BV along with the powdered bakelite decreases the dust emission of MM and its sticking to the metal pattern and also promotes the uniform distribution of the binder among the sand grains. The σ_b in tension of MM, determined on figure eights 10 mm thick, when the mixture contains 6% powdered bakelite and BV is 30 - 35 and 20 - 25 kg/cm^2,

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respectively (for K 70/140 sand); the use of finer sand greatly decreases the σ_b in tension of SM (to 7 kg/cm^2 for 270-undersize sand with 10% binder). For the preparation of SM the author recommends the use of refractory materials with the particle-size modulus in the 70 - 200 range. For steel casting the use of magnesite, chrome-magnesite, chromite ore, etc., is recommended. For the determination of the rate of accumulation of MM on the hot pattern the following relationship was established: $X = k\sqrt{\tau}$, where X is the thickness of the SM (in mm), τ is the time the MM remains on the plate (in sec), k is a coefficient; when the patterns used are heated to 150, 180, and 250°, k equals 1.73, 2.05, and 2.45 mm/sec$^{1/2}$, respectively (for MM consisting of K 70/140 sand and 6% dry BV). The values for k which were determined under the same conditions for sand, chrome-magnesite, and chromite ore are 2.05, 1.41, and 1.1. It was established that when the excess material is returned to the hopper, the sand SM collapse easier than the chrome-magnesite or chromite SM. When SM are prepared on flat patterns < 10 mm high pouring of MM into a frame 6 - 7 mm higher than the pattern is recommended to avoid the collapse of the mold.

Ya. M.

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KOLACHEVA, O.V.

GULYAYEV, B.B; KOLACHEVA, O.V.; LUPYREV, I.I.; SHAPRANOV, I.A.

"Casting in shell molds; review of foreign publications" by N.A. Sokolov, Lit.proizv. no.1:27-28 Ja '57. (MIRA 10:3)
(Founding) (Shell molding (Founding))

KOLACHEVA, O.V.

25(1) p.3 PHASE I BOOK EXPLOITATION SOV/1440

Nauchno-tekhnicheskoye obshchestvo mashinostroitel'noy promyshlennosti. Leningradskoye oblastnoye pravleniye

Lit'ye povyshennoy tochnosti (High-precision Casting) Moscow, Mashgiz, 1958. 196 p. (Series: Its: Sbornik, kn.45) 7,000 copies printed.

Ed.: A.N. Sokolov; Tech. Ed.: L.V. Sokolova; Managing Ed. for Literature on Machine-building Technology (Leningrad Division, Mashgiz): Ye. P. Naumov, Engineer.

PURPOSE: This book is intended for engineers and technicians at foundries and planning and research institutes.

COVERAGE: The book contains the transactions of a special conference called in November, 1956, by the Leningrad Oblast Administration of the Nauchno-tekhnicheskoye obshchestvo NTO (Scientific and Technical Society of the Machine-building Industry). The articles describe advanced techniques used in

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High-precision Casting SOV/1440

precision-casting processes such as shell molding, investment casting, pressure die casting, press die casting (called in Russian "forging of liquid metal"), and suction casting. Special attention is given to the production of large precision castings, one of the principal problems in the industry. At the same time, methods of improving the precision of sand-mold castings are examined. Experience gained in the mechanization of precision-casting and shell-molding processes is reported. Information is given on the present state of precision casting, both in the USSR and elsewhere. No personalities are mentioned.

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KOLACHEVA, O.V.

VYSHEMIRSKIY, Mikhail Mikhaylovich; SOKOLOV, A.N., kand. tekhn. nauk, retsenzent; KOLACHEVA, O.V., insh., red.; VARKOVETSKAYA, A.I., red. izd-va; SOKOLOVA, L.V., tekhn. red.

[Metal molder and caster] Formovshchik. Moskva, Gos. nauchno-tekhn. izd-vo mashinostroit. lit-ry, 1958. 210 p. (MIRA 11:10)
(Founding)

S/123/60/000/021/004/004
A005/A001

Translation from: Referativnyy zhurnal, Mashinostroyeniye, 1960, No. 21, p. 197, # 116748

AUTHOR: Kolacheva, O. V.

TITLE: Substitutes of Ethyl Ortho-Silicate for Investment Casting

PERIODICAL: Sb. statey po formovochn. materialam. Moscow, 1958, pp. 40-49

TEXT: Two kinds of substitutes of ethyl ortho-silicate were developed and introduced into practice: the binder ДС (DS), being the product of treatment of a water glass solution by electrodialysis, and the binder КС (KS), being the product of treatment of a water glass solution by ion exchange. The author recommends to use, for the treatment of water glass solutions by electrodialysis and ion exchange, hydrochloric acid solutions the composition of which is calculated according to the chemical analysis of the initial water glass. The content of silicon dioxide in the hydrochloric acid solution subjected to the treatment by electrodialysis has to be not greater than 7.5%, and for the treatment by ion exchange not greater than 10%. The quantity of water glass, hydrochloric acid, and distilled water for the preparation of the hydrochloric acid solution must be

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Substitutes of Ethyl Ortho-Silicate for Investment Casting

taken with the consideration of the mentioned limiting contents of silicon dioxide. The solutions of water glass and hydrochloric acid are prepared separately in clean vessels; 68% of the distilled water volume is used for the dilution of the water glass, and 32% for the dilution of the hydrochloric acid. The vessel with the diluted hydrochloric acid. The vessel with the diluted hydrochloric acid is set under the paddle mixer, and the mixed water glass solution is added carefully in a fine stream at continuous mixing. The reverse sequence of infusion is not admissible. The DS binder is obtained by electrodialysis of the hydrochloric acid solution in a wooden or rubber tank divided into 3 sections by semipermeable diaphragms (cellophane foils). The hydrochloric acid solution is filled into the middle section, the by-sections are charged with tap water. The electrodes are arranged at a distance of 100-120 mm in the by-sections. The cathode is a tin plate, the anode is a graphite- or a corbon rod. The electro-dialysis is performed until obtaining the solution viscosity of 1.7. The prepared solution is cooled down to room temperature and diluted with ethyl alcohol. The duration of storage is 3-5 days. The KS binder is obtained by filtration of the hydrochloric acid solution of water glass through a layer of cationite-resin absorbing the sodium

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SOV/123-59-15-60525

Translation from: Referativnyy zhurnal. Mashinostroyeniye, 1959, Nr 15, p 232 (USSR)

AUTHOR: Kolacheva, O.V.

TITLE: Investigation of the Thermal Conditions of Solidification of Castings in Shell Molds

PERIODICAL: V sb.: Zatverdevaniye metallov. Moscow. Mashgiz, 1958, pp 231 - 242

ABSTRACT: As shell molds have thin walls peculiar thermal conditions of solidification and cooling of castings prevail. Tests for the investigation of the thermal conditions of shell molds made of a bakelite mixture and of the steel solidification process in them were carried out in casting a box-type mold measuring 100 · 100 · 210 mm with the following thicknesses of walls: 5 mm, 15 mm, 30 mm. The molds were made of a K50/100 sand mixture with 6% of bakelite lacquer and were filled with steel of the 35L grade. The results of temperature measurements during the filling of castings of different thickness are stated. Based on the temperature curves temperature fields were plotted of the mold walls and castings at various time instants from the beginning of the filling. At the free pouring of the shell molds with a bakelite binder, a second heating source of the mold walls is created by the burning of the

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Investigation of the Thermal Conditions of Solidification of Castings in Shell Molds

bakelite which changes the character of the temperature field in the mold walls. When applying filling the temperature field in the mold is analogous to the pouring into sand molds. The analysis of the curves of solidification of castings with different thickness of walls, obtained by measuring temperatures, permitted to calculate the coefficient of solidification which was equal to 0.1 sec 1/2 and to plot the theoretical graph of solidification. The methods of tests were worked out and investigations were carried out of the strength of the bakelite mixture at high temperatures and of the resistance to heat of the shell molds under the pouring conditions investigated. The design of the pattern was improved upon and a test device manufactured. The specimen to be tested was clamped in the chuck of the device, then a furnace, heated up to 700°C, was moved towards it and the specimen was subjected to heat during 30 sec, and afterwards it was destroyed by stretching. Even at a short spell of high temperature the strength of the mixture is lowered considerably and amounts to 10 - 15% of the initial one only. Methods of determining the resistance to heat of the mold were developed on the basis of hydrostatics since actually the resistance of the mold is reduced immediately after being filled with metal while pressure affects the mold only in the already filled part of the casting. The minimum wall thickness of the mold necessary to preserve it until a hard

SOV/123-59-15-60525

Investigation of the Thermal Conditions of Solidification of Castings in Shell Molds

skin of metal is formed should be not less than 8.5 mm. The strength of the shell mold when filled with steel does not exceed 1.7 kg/cm^2, while the grain size of the mixture and the character of the thermoreactive binder do not affect the resistance to heat of shell molds. The duration of the pouring process has a considerable effect on the resistance to heat of the shell molds, therefore they should be filled rapidly and through a dispersed gate system. 8 figures.

Zh.S.S.

Card 3/3

GULYAYEV, Boris Borisovich. Prinimali uchastiye: SHAPRANOV, I.A., kand.tekhn. nauk; MAGNITSKIY, O.N., kand.tekhn.nauk; POSTNOV, L.M., kand.tekhn. nauk; BOROVSKIY, Yu.F., kand.tekhn.nauk; KOLACHEVA, O.V., kand. tekhn.nauk. BERG, P.O., prof., doktor tekhn.nauk, zasluzhennyy deyatel' nauki i tekhniki, retsenzent; PROZHOGIN, A.A., nauchnyy red.; CHFAS, M.A., red.izd-va; KONTOROVICH, A.I., tekhn.red.; SPERANSKAYA, O.V., tekhn.red.

[Founding processes] Liteinye protsessy. Moskva, Gos.nauchno-tekhn.izd-vo mashinostroit.lit-ry, 1960. 415 p. (MIRA 13:7)

(Founding)

KOLACHEVA, O. V.

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PHASE I BOOK EXPLOITATION SOV/5458

Girshovich, Naum Grigor'yevich, Doctor of Technical Sciences, Professor, ed.

Spravochnik po chugunnomu lit'yu (Handbook on Iron Castings) 2d ed., rev. and enl. Moscow, Mashgiz, 1961. 800 p. Errata slip inserted. 16,000 copies printed.

Reviewer: P. P. Berg, Doctor of Technical Sciences, Professor; Ed.: I. A. Baranov, Engineer; Ed. of Publishing House: T. L. Leykina; Tech. Eds.: O. V. Speranskaya and P. S. Frumkin; Managing Ed. for Literature on Machine-Building Technology (Leningrad Department, Mashgiz): Ye. P. Naumov, Engineer.

PURPOSE: This handbook is intended for technical personnel at cast-iron foundries. It may also be of use to skilled workmen in foundries and students specializing in founding.

COVERAGE: The handbook contains information on basic problems in the modern manufacture of iron castings. The following are discussed: the composition and properties of the metal; the making of molds; special casting methods; the charge preparation; melting

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and modifying the cast iron; pouring, shaking out, and cleaning of castings; heat-treatment methods; and the inspection and rejection of castings. Information on foundry equipment and on the mechanization of castings production is also presented. The authors thank Professor P. P. Berg, Doctor of Technical Sciences, and staff members of the Mosstankolit Plant, headed by the chief metallurgist G. I. Kletskin, Candidate of Technical Sciences, for their assistance. References follow each chapter. There are 287 references, mostly Soviet.

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ACC NR: AT7001920 SOURCE CODE: UR/3010/66/000/017/0055/0058

AUTHOR: Berlyand, O. S.; Yerokhina, R. A.; Kolacheva, Z. A.

ORG: none

TITLE: Exchange of air masses between the stratosphere and troposphere in the Northern Hemisphere

SOURCE: AN SSSR. Mezhduvedomstvennyy geofizicheskiy komitet. Geofizicheskiy byulleten', no. 17, 1966, 55-58

TOPIC TAGS: atmospheric circulation, stratosphere, troposphere, atmospheric temperature, temperature distribution

ABSTRACT: This article presents the results of an investigation of the mechanism of exchange of air masses between the troposphere and stratosphere for given mean annual zonal distributions of temperature in the 0—16 km layer and the distribution of atmospheric pressure on the Earth's surface by finding a wind velocity field for determining the vertical motion of air masses. It was calculated that during a year an air mass weighing $3 \cdot 10^{14}$ t, which amounts to 5% of the weight of the entire atmosphere, descends from the tropopause in the 25—35°N zone. The weight of the 10—16-km air layer amounted to approximately 1/6 of the weight of the entire atmosphere. Thus, it is concluded that exchange of the entire air mass between the troposphere and stratosphere occurs within about 3.5 years in the 25—35°N region. Orig. art.

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KOLACHEVSKIY, N.N.

USSR/Physics - Magnetic flux FD-1485

Card 1/1 : Pub. 146-8/20

Author : Grachev, A. A.; Goronina, K. A.; Kolachevskiy, N. N.; and Andrianova, I. A.

Title : Experimental investigation of variation of magnetic flux in a cable at reversal of magnetization of one domain

Periodical : Zhur. eksp, i teor. fiz., 27, 313-317, Sep 1954

Abstract : Results of experimental investigation of magnetic flux generated in a single domain of a ferromagnetic cable are outlined. Experimental data concur within 10% accuracy with theoretical computation by S. M. Rytov (ibid, 307-312). Four references.

Institution : Physicotechnical Institute, Gor'kiy State University

Submitted : December 28, 1953

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PHASE I BOOK EXPLOITATION 1127

Moscow. Fiziko-tekhnicheskiy institut

Issledovaniya po fizike i radiotekhnike (Research in Physics and Radio Engineering) Moscow, Oborongiz, 1958. 132 p. (Series: Its Trudy, vyp. 2) 3,700 copies printed.

Ed.: Zaytseva, K.Ya., Engineer; Ed. of Publishing House: Gortsuyeva, N.A.; Tech. Ed.: Rozhin, V.P.; Managing Ed.: Zaymovskaya, A.S., Engineer.

PURPOSE: The book may be useful to scientific personnel, engineers, and students conducting research in physics and radio engineering.

COVERAGE: The book is a collection of 13 articles written by instructors and graduate and undergraduate students of the Moscow Institute of Physics and Technology. The articles discuss problems in radio physics, optics and physics. No personalities are mentioned. References appear at the end of each article.

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PHASE I BOOK EXPLOITATION SOV/3827

Moscow. Fiziko-tekhnicheskiy institut

Issledovaniya po fizike i radiotekhnike (Research in Physics and Radio Engineering) Moscow, Oborongiz, 1959. 170 p. (Series: Its: Trudy, vyp. 4) Errata slip inserted, 2,150 copies printed.

Sponsoring Agency: RSFSR. Ministerstvo vysshego i srednego spetsial'nogo obrazovaniya.

Ed.: K.Ya. Zaytseva, Engineer; Ed. of Publishing House: S.D. Antonova; Tech. Ed.: L.A. Garnukhina; Managing Ed.: A.S. Zamovskaya, Engineer.

PURPOSE: This book is intended for scientific workers, students in advanced courses and engineers.

COVERAGE: This is a collection of 15 studies dealing with problems of radio physics, electronics, quantum physics, and aerodynamics. The studies examine the method of least squares as applied to the propagation of radio waves in the presence of a plane junction, the general conditions of stability of a random process at the output of a linear filter while a periodic unstable

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random process is supplied at the input of the filter, the results of experiments with a ferromagnetic specimen with large Barkhausen jumps as an explanation of the noise mechanism in ferromagnets at cyclic magnetization reversal, experiments for the determination of thermal characteristics and the results of an experimental study of a turbulent boundary layer in a supersonic flow. No personalities are mentioned. References accompany most articles.

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for the process are determined. Exact values of Fourier expansion coefficients of the correlation function for an oscillation circuit with a high-quality factor used as a filter and a process at the input representing a modulated periodic white noise are established.

Kolachevskiy, N.N. Ferromagnetic Core With Large Barkhausen Jumps in an Alternating Magnetic Field 17

Problems concerning the emergence of cyclic magnetization reversal noise in specimens with a single Barkhausen jump are discussed. The continuous spectrum of emf induction in an induction coil, taking into account the induction reversal component, is determined. The experiments with large Barkhausen jumps show that it is erroneous to explain noise by the temporary fluctuations of the jump emergence moments. Noise should be calculated on the basis of fluctuations of the magnetic moment at the jump. The inclusion of the reversal component results in a drop of the spectral noise density at frequencies of $\omega = 3\omega$ and conversion of the spectral intensity to zero at $\omega = 0$. In this connection it is pointed out that the extrapolation of the spectral intensity curve to a different value than zero at $\omega \rightarrow 0$ as it is done by

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